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ABSTRACT

The main and interactive effects of classroom openness on the achievement and creativity of 103 third graders and 97 fourth graders were assessed by multiple regression analyses. After controlling for student IQ, socioeconomic status, sex, age, anxiety and "family openness," classroom openness was found to be negatively related to achievement and creativity measures at both grade levels. However, the increments in explained variance attributable to classroom openness were consistently significant for the fourth grade only. Two student characteristic X classroom openness interactions were found, each of which affected verbal creativity. Further attention to IQ X classroom structure interactions is suggested in this paper. (Author/WI)

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# CLASSROOM OPENNESS: INTERACTIVE AND MAIN EFFECTS ON ACHIEVEMENT AND CREATIVITY

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## INTRODUCTION

Since the mid 1960's "open education" has received an increasing amount of attention. However, in spite of the volume of studies, few definitive statements can be made about the effect of open education on student outcomes. Looking at studies which considered the effects of open education on achievement or creativity, one finds mixed results for both student outcomes. Gardner (1966; for students at the Junior School level) and Abelson, Zigler and DeBlasi (1974) report that open education is positively related to achievement. However, other investigators report negative effects [Gardner, 1966 (for students at the Infant School level); Ward and Barcher, 1975 (for high IQ students), Wright, 1975; Bennett, 1976; and Solomon and Kendall, 1976], while still others [Tuckman, Cochran and Travers (Note 1), Trotta (1973), Groobman, Forward and Peterson (1976) and McPartland and Epstein (1977)] report no clear pattern of differences. The picture for creativity is no clearer. Haddon and Lytton's (1968) and Solomon and Kendall's (1976) results suggest that children who experience open education are more creative than their peers in traditional classrooms, yet Bennett (1976) reports no difference in creative writing due to classroom openness. The relationship of open education to creativity for Abelson et. al. (1974), Ramey and Piper (1974), and Ward and Barcher (1975) varied within each study depending upon whether one was considering a verbal or nonverbal measure of creativity.

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Failure to find consistent effects for openness across studies could be due to one or both of two factors: (1) failure of the investigator to adequately control for variables which may be confounded with openness and which may affect the outcome measures under consideration and (2) failure of the investigator to

take account of individual student characteristics which may interact with classroom openness to affect student outcomes.

Investigators have attempted to deal with the first problem by matching open and traditional students on the variables they'd like to control for. However, matching as a way of controlling for variables limits the number of variables which can be controlled in any one study (usually no more than 3 or 4) since each matching criterion typically results in some subjects being eliminated from the study. This study used multiple regression techniques to statistically control for a variety of student background variables, thus avoiding any subject attrition.

The second problem has been ignored except for a few investigators (e.g., Trotta, 1973; Solomon and Kendall, 1976; McPartland and Epstein, 1977), yet the writings of Cronbach (1967) and Berliner and Cahen (1973) suggest that student trait by situation interactions might be a fruitful area for exploration. Rather than asking whether open or tradition education is "better" for all children, this study attempted to examine whether classroom openness differentially affected the achievement and creativity of children with different characteristics.

This study had two objectives: 1) to investigate the effect of classroom openness on achievement and creativity after controlling for several student background variables [student's IQ, SES, sex, anxiety, age in months, family decision-making style (a measure of family "openness")] and 2) to investigate whether certain student characteristics interacted with classroom openness to affect student achievement and creativity. Four of the student background variables (SES, IQ, anxiety and family decision-making style) were hypothesized to be student characteristics which would interact with classroom openness to affect student achievement and creativity. Consequently, four interaction variables were created by calculating the product of each of the four student

characteristic measures with the openness score of his or her class: openness by SES, openness by IQ, openness by anxiety and openness by family decision-making style. In the analyses to be described below these four interaction variables were treated as predictor variables.

## METHOD

### Subjects

The study was carried out in ten classrooms within one elementary school in upstate New York. The population was primarily lower-middle class in terms of education, income and occupation.

Six classes were selected as examples of open classrooms based on the teachers' past efforts to become open. Four years prior to the study described here, the teachers of these classes had worked with college consultants to develop open classrooms. An observational study (Amato, 1976) carried out concurrently with the present study found distinct differences between these classes and the classes selected as the traditional comparison group: the students in the open classrooms spent a greater percentage of time than students in the traditional classrooms conversing with their peers, working in small groups and working without the teacher's attention; the students in the traditional classrooms spent a greater percentage of time than their open classroom peers observing or listening, involved with the teacher and involved with 10 or more other students.

The six open teachers each completed The Dimensions of Schooling Questionnaire (DISC), a 30 item teacher self-report instrument developed to elicit information about aspects of classroom settings that are hypothesized to be related to the implementation of an open environment (Traub, Weiss, Fisher and Musella, 1972). The scores for the six open teachers ranged from 11.46 to 16.35, with a mean of 14.00.

The DISC was also completed by all traditional teachers in the same school (N=10). The traditional classes were all third or fourth grades, with each class having students of only one grade level. The open classes each had a mix of 2nd, 3rd and 4th graders. To insure that a comparable number of open and traditional students were sampled, two traditional classes at the 3rd grade level and two at the 4th grade level were selected. The two teachers at each grade level with the lowest DISC scores were chosen to provide maximum contrast with the open teachers and so that the overall range of classroom openness scores would be broad. The four traditional teachers so selected had DISC scores ranging from 8.94 to 10.53, with a mean of 9.62.

Complete data was obtained for 100 students in the six open classes (49 third graders and 51 fourth graders) and for 100 students in the four traditional classes (54 third graders and 46 fourth graders).

Measures

Instruments measuring two student background variables and student creativity were administered to all children in the study in May, 1976.

Student background variables: Students' anxiety was assessed by the Children's Manifest Anxiety Test (Castaneda, McCandless and Palermo, 1956). The style of decision-making in students' homes was assessed by the Family Decision Making Scale (adapted from an instrument developed by Epstein and McPartland, Note 2).

Student creativity: Measures of figural and verbal creativity were obtained by administering the "circle game" (figural) and "uses" (verbal) subtests of the Torrance Tests of Creative Thinking (Torrance, 1966). Each test was scored for flexibility, fluency, originality and elaboration but only the total score for each test was used in the analyses presented below.

Procedure

The DISC was administered to all teachers in one group session in November, 1975. Information on student age, grade, sex and IQ and father's occupation were obtained from each student's school file. The occupation part of Hollingshead's Two Factor Index of Social Position was used to rate father's occupation (or mother's where no male guardian was present in the household) and arrive at a measure of SES. When an IQ score was not present in a student's file, the verbal battery of the Lorge-Thorndike Intelligence Test was administered.

Measures of student achievement were obtained from the school. Each Spring the Iowa Tests of Basic Skills were given as part of the school's standard assessment procedure. The following grade equivalent scores were obtained from the school for each student: Composite, Language Total, Math Total and Reading Comprehension.

The instruments mentioned in the Measures section, along with several others, were administered in three sessions (each approximately 50 minutes long) to groups of from 25 to 60 children during the month of May. Whenever more than 25 students were tested two adults were always present to administer the instruments and answer questions.

## RESULTS

Multiple regression analyses were done to investigate (1) how much classroom openness contributed to the prediction, or the amount of explained variance, of the outcome measures after the six student background variables had been controlled, and (2) whether certain student characteristics (IQ, SES, anxiety, family decision-making style) interacted with classroom openness to affect student outcome measures. In addressing both objectives, separate analyses were carried out for the third and fourth grades.

The regression analysis proceeded in several steps. First, the six student background measures were entered into regression equations for each of the achieve-

ment and creativity measures and the squared multiple correlation coefficient ($R^2$), the amount of variance explained by the set of background variables, was noted. A second set of analyses were then carried out in which the classroom openness measure was added to regressions which already included the six student background measures as predictor variables. The increase in $R^2$ for each outcome variable, which represents the unique contribution of classroom openness to the explained variance in the outcome measure, was tested for statistical significance by an F test. In Table 1, the increments in the percent of variance explained are presented for the six student outcome measures for the 3rd and 4th grades separately. The sign appearing before each value in Table 1 indicates the direction of the relationship between classroom openness and the outcome measure. A (-) sign indicates that the relation of classroom openness to an outcome measure, independent of the effect of the six student background measures, is negative (i.e., as the openness score increases, the outcome score decreases); in contrast no sign is indicative of a positive relationship between classroom openness and an outcome variable.

Looking at the results for the third grade, one finds that classroom openness uniquely accounted for only small increments in the amount of variance explained in student outcome measures: less than one percent for four of the six outcomes and less than four percent for the others. Classroom openness accounted for a significant increment in variance explained for only one student outcome: Language Total. In this instance, as for all the other student outcomes, classroom openness showed a negative relationship to the outcome measure, that is, higher classroom openness scores were associated with lower scores on the student outcome measures.

At the fourth grade level, Table 1 reveals negative relationships between classroom openness and the four achievement measures and the two creativity measures. For each of the student outcome measures which were negatively related to classroom openness, classroom openness accounted for a significant increment in the amount

of variance explained. ranging from 3.1 percent for Reading Comprehension to 8.3 percent for Verbal Creativity.

The fourth grade results require further discussion. Looking at the achievement measures, classroom openness was negatively related to all measures and accounted for significant increments in variance explained. However, in all instances the increment in variance explained was less than six percent. Consequently, although classroom openness has a statistically significant negative effect on achievement, the practical significance of these findings is questionable.

Turning to the results for the creativity measures, the findings raise some questions about open education. One supposed benefit of open education is an enhancement (or maintenance) of creativity. While proponents of open education do not assume that open education will necessarily result in greater achievement, they often assert that children in open classrooms will be more creative. This study found no evidence that classroom openness enhanced creativity, rather it found the opposite. The unique contributions of classroom openness to explained variance in verbal and figural creativity were significant, but negative. Higher openness scores were associated with lower creativity scores. One possible explanation for the verbal creativity results is that the decrements in language achievement associated with classroom openness affected the verbal creativity scores. The author offers no hypotheses about the figural creativity results.

It is interesting that only one significant finding occurred at the third grade level, while six out of six student outcome measures showed significant relationships with classroom openness at the fourth grade level. One way in which the third and fourth grades differed was that most of the fourth grade children in the open classes had experienced one more year of open education than children in the third grade. It may be that the effects of classroom openness are cumulative--minimal initially but increasing with each additional year.

To investigate the above hypotheses, a "Years in Open" measure (a score of "0" was assigned for no open classroom experience, the score for most of the students in the traditional classes; "1" for 1 year, etc., with a maximum score of "3", since the earliest children were assigned to an open classroom was in second grade) was added to regressions which already included the six student background measures as predictor variables. The increase in $R^2$ for each outcome measure was tested for significance by an F test. In Table 2 the increments in the percent of variance explained are presented for the six student outcome measures for the third and fourth grades separately. The sign before each percent indicates the direction of the relationship between the Years in Open measure and the outcome measure.

Looking at Table 2 one notices that the results for Years in Open are very similar to the results for classroom openness at both the third and fourth grade levels. At each grade level the direction of the relationships with the outcome measures are the same for classroom openness as for Years in Open. However, for the four achievement measures the magnitude of these relationships are larger for Years in Open at both the third and fourth grade levels. That is, the increment in explained variance for each achievement measure is greater when the Years in Open measure is added to the regression than when the classroom openness measure is added. However, only one such increment (that for Language Total) is significant at the third grade level, while all increments at the fourth grade level are significant. This pattern of results suggests that being in open classrooms may have a cumulative effect on achievement, but the effect may only reach significance when the child has been in an open classroom for at least three years.

The second objective of this study was to investigate whether certain student characteristics interacted with classroom openness to affect student achievement and creativity measures. In this study, students' SES, IQ, anxiety and their

family's decision-making style (a measure of family "openness") were selected as the student characteristics to be investigated. Four interaction variables were created for regression analyses by calculating the product of each of the student characteristic scores with the classroom openness score of a child's class, resulting in four interaction variables: openness by SES, openness by IQ, openness by anxiety and openness by family decision-making style. For each interaction variable, the objective of all analyses was to determine whether the effect of classroom openness on the outcome measures varied as a function of students' scores on the student characteristic measure which was part of the interaction term. For example, "Do low IQ students benefit more from relatively open classrooms than high IQ students?"

To assess the importance of each interaction variable for each student outcome, each interaction variable was added to regressions which already included the six student background measures and the classroom openness measure as predictor variables. The increment in variance explained in each outcome measure when each interaction variable was added singly was then tested for significance. As in earlier analyses, regression analyses were conducted separately for third and fourth grades.

Two of the interaction variables resulted in significant increments in explained variance in the verbal creativity measure. At the third grade level, the openness by family decision making style interaction variable resulted in a significant increment in the variance explained in the verbal creativity measure. To investigate this effect further, the third grade sample was divided into two groups based on the Family Decision Making score: students with scores less than or equal to 5 formed the Low group and students with scores more than or equal to 6 formed the High group. For each group, separate regression analyses were

carried out for the verbal creativity measure with classroom openness being added to the regressions which already included the six student background measures as predictor variables. The direction of the relationship between classroom openness and the verbal creativity measure was noted and the increment in $R^2$ was tested for significance. Classroom openness was found to be negatively related to verbal creativity within the Low group and positively related to verbal creativity within the High group. The increments in explained variance did not attain significance within either group. These findings suggest that the conflict between a traditional family and an open classroom may adversely affect a child's verbal creativity, while congruence between the home and school may facilitate it.

At the fourth grade level, the openness by IQ interaction variable produced a significant increment in variance explained in the verbal creativity measure. To explore this effect further, students in the fourth grade sample were divided into High and Low IQ groups based on whether their IQ score was above or below the median score for fourth graders. Students with IQ scores which were less than or equal to 110 formed the Low groups and students with IQ's above 110 formed the High group. For each group, separate regression analyses were carried out for the verbal creativity measure with classroom openness being added to the regressions which already included the six student background measures as predictor variables. For both the High and Low IQ groups classroom openness was found to be negatively related to the verbal creativity measure. However, for the Low IQ group this negative relationship was significant at the .01 level and classroom openness was responsible for a substantial increment in variance explained of 29.3 percent (compared with an increment of .1 percent for the High IQ group).

## DISCUSSION AND CONCLUSIONS

Looking at the pattern of results for the third grade, classroom openness did not seem to have much of an effect on the achievement and creativity measures

selected for study, neither as a main effect nor in interaction with several student characteristics.

At the fourth grade level, both classroom openness and Years in Open resulted in significant increments in variance explained in the achievement measures, with the latter variable being associated with larger increments than the former. These findings suggest that the effects of classroom openness are cumulative in nature, with the effect of classroom openness only reaching significance when students have been in open classrooms for three years. Why fourth graders were affected in this manner is open to conjecture. It may be that multi-age grouping, which was a component of the open classrooms, may academically hurt the older students in the group. Although the older students have a chance to tutor younger students, they may suffer from the relatively smaller number of peers at approximately the same or higher level of competence as themselves. It may be that the fourth grade curriculum is slighted to some extent as the teachers must be concerned with three grade levels. Coverage of the curricula for the second and third grades may seem more urgent, since the curricula at these levels deal with the teaching of basic skills more so than the curriculum for the fourth grade.

A finding of interest at the fourth grade level was that the verbal creativity of students with low IQ's was more negatively affected by classroom openness than that of students with high IQ's. Ward and Barcher (1975) also found that low and high IQ students were differentially affected by classroom structure. However, in their study open classroom experience was associated with lower achievement and figural creativity for the high IQ group. Given these conflicting findings, IQ is one student characteristic which deserves the continued attention of investigators as a factor which may interact with classroom openness to affect student outcomes.

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TABLE 1

UNIQUE CONTRIBUTIONS OF CLASSROOM OPENNESS TO PERCENT OF EXPLAINED VARIANCE IN STUDENT OUTCOME MEASURES, BY STUDENT OUTCOME AND GRADE

| | STUDENT OUTCOME MEASURES | | | | | | |
|---|---|---|---|---|---|---|---|
| | Composite | Reading Comprehension | Language Total | Math Total | Verbal Creativity | Figural Creativity | N |
| Third Grade | (-)1.19 | (-)0.88 | (-)3.17* | (-)0.00 | (-)0.03 | (-)0.07 | 103 |
| Fourth Grade | (-)4.30*** | (-)3.08* | (-)5.24** | (-)5.40*** | (-)8.34*** | (-)4.84* | 97 |

* $p < .05$
** $p < .01$
*** $p < .001$

Note: When the sign before a value is negative this indicates that the relationship of classroom openness to the outcome measure, net of the effect of the six student background measures, is negative.

TABLE 2

UNIQUE CONTRIBUTIONS OF YEARS IN OPEN TO PERCENT OF EXPLAINED VARIANCE IN STUDENT OUTCOME MEASURES, BY STUDENT OUTCOME AND GRADE

| | STUDENT OUTCOME MEASURES | | | | | | |
|---|---|---|---|---|---|---|---|
| | Composite | Reading Comprehension | Language Total | Math Total | Verbal Creativity | Figural Creativity | N |
| Third Grade | (-)2.50 | (-)2.60 | (-)5.46** | (-)0.17 | (-)3.00 | (-)0.09 | 103 |
| Fourth Grade | (-)6.51*** | (-)6.34*** | (-)9.66*** | (-)9.34*** | (-)4.40* | (-)0.17 | 97 |

* $p < .05$
** $p < .01$
*** $p < .001$

Note; When the sign before a value is negative this indicates that the relationship of Years in Open to the outcome measure, net of the effect of the six student background measures, is negative.